

# **Final Report**

## HR Vertilog Inspection Survey

Conducted for:

**Inergy Midstream**

US Salt

US Salt #58

Run date: March 24, 2011

Report date: March 27, 2011



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Baker Atlas



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## Baker Atlas

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Baker Atlas

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## Executive Summary

On March 24, 2011, Baker Atlas, operating from Buckhannon WV completed a HR Vertilog magnetic flux leakage (MFL) casing inspection survey on the Inergy Midstream US Salt US Salt #58.

A total of [REDACTED] individual joints of casing were identified during the inspection survey. Within this report, the term "casing" is intended to mean the downhole tubulars which are the subject of the survey, and which may include well casings, liners or production tubing.

A total of [REDACTED] metal loss features exceeding the 20% reporting threshold were identified during the HR Vertilog survey. Of the [REDACTED] total metal loss features [REDACTED] were identified as internal features, and [REDACTED] were identified as external features.

A total of [REDACTED] metal loss features exhibited predicted depths exceeding 50% of wall thickness. The maximum depth among all metal loss features was [REDACTED].

A total of [REDACTED] metal loss features exhibited ERF values exceeding 1.0. The maximum ERF among all metal loss features was [REDACTED].

This Final Report is intended to serve as an overall summary of the inspection results. The accompanying InSight Data CD contains a comprehensive Feature List which represents the complete findings of the HR Vertilog casing survey.

## 1. Job Information

Baker Atlas completed a HR Vertilog casing inspection survey on the Inergy Midstream US Salt #58 on March 24, 2011. The job parameters are summarized in the following well, service and equipment data tables.

### 1.1. Well Data

The following well data and casing records were provided by representatives of Inergy Midstream.

Table 1. Well Data

Well Identification					
Company	Inergy Midstream				
Well	US Salt #58				
Field	US Salt				
County/Parish	Schuyler				
State/Province	New York				
Country					
API Number					
Location					
Section	N/A	Township	N/A	Range	N/A
Elevations					
Kelly Bushing	0.00 feet				
Drilling Floor	0.00 feet				
Ground/Sea Floor	0.00 feet				
Permanent Datum Is	G.L.	Permanent Datum Elevation	0.00 feet		
Log Measured From	M.G.	Height Above Datum	2.00 feet		
Drilling Measured From	K.B.	Height Above Datum	0.00 feet		
Borehole Information					
Fluid	Fresh Water	Wellhead Pressure	0 psi	Well Depth	2170.00 feet
Casing Record					
Size	Weight	Grade	From	To	Length
9.625 in	36.0 lb/ft	J55	0.00 ft	2183.00 ft	2183.00 ft



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## 1.2. Service Data

The Baker Atlas field services are summarized in the table below.

Table 2. Service Data

Service information	
Job Date	March 24, 2011
Service Order	US597518
Recorded By	A. Anderson
Witnessed By	Mr. Barry Moon
Service Location	Buckhannon WV
Service Unit Number	9701
Logging information	
Service	HVRT
Bottom Logged Interval	2159.20 feet
Top Logged Interval	-3.13 feet
Additional Services	
Remarks:	
Thank you for choosing Baker Atlas. Crew on your location : M. Cutlip , Dave Will. JCGR 8.5" ran to 2170. N/A = not applicable.  Engineer's remarks are included above. While no outer casing string is listed on the log heading, an outer casing string exists, size, weight, and grade unknown. Log depth of bottom of this string: 163.75 ft. Outer casing string collars are present on the FL signal in some intervals, see 42.64 ft., for example. Centralizers are present at the following depths: 915.76, 1318.03, 1721.87, 2083.03, and 2125.71 ft.	

## 1.3. Pressure Calculations

The following information was provided by Inergy Midstream for use in pressure calculations.

Pressure Calculations:	
Burst Pressure Calculation	[REDACTED]
Interaction Criteria	[REDACTED]

#### 1.4. Equipment Data

The following Baker Atlas equipment assets were utilized in the performance of the inspection services.

Table 3. Equipment Data

Equipment Data	
Tool Series Number	7 to 9-5/8 inch HRVRT 96 FL + 96 DIS Tool
Electronics Series Number	MuxDB
Interface Panel Series Number	4921
Calibration Reference Number	
Acquisition Software	Microvision 32-bit 4.3.2.0
Analysis Software	Insight 2.2.5.2276

Diagram of the 4993EA probe assembly showing dimensions and labels:

- 4993EA**  
65.67in [1749 mm]
- Ø2.63in**  
[67 mm]
- WHEEL TRAVEL RANGE**  
5.30 in [135 mm] MAX  
4.00 in [102 mm] MIN
- 4995RA (4X)**
- DISC. MEASURE POINT:**  
94.76 in [2407 mm]
- FL MEASURE POINTS:**  
AXIAL: 84.51 in [2147 mm]  
RADIAL: 84.61 in [2149 mm]  
CIRCUM: 84.41 in [2144 mm]
- Ø2.375in**  
[86 mm]
- 4995RA (4X)**
- DISC. MEASURE POINT:**  
35.63 in [986 mm]
- FL MEASURE POINTS:**  
AXIAL: 25.58 in [726 mm]  
RADIAL: 25.65 in [728 mm]  
CIRCUM: 25.48 in [723 mm]
- 4995SQE**  
55.67in [1491 mm]
- 1.51in**  
[43 mm] FIELD PLUG
- ZERO POINT: 0 in. [0mm]**
- MAKE-UP LENGTH**  
185.67in [4716 mm]



## 2. Casing Configuration

### 2.1. Casing Segments

For the purpose of this report, a casing "segment" refers to an interval of casing with consistent physical properties and operating parameters. The concept of casing segments is used within the context of this report to define casing intervals for the purpose of pressure-based analysis, including burst strength analysis and pressure ratio calculations.

Casing segments with consistent nominal wall thickness (T), external diameter (D), maximum allowable operating pressure (MAOP), internal design pressure (P<sub>i</sub>), and specified minimum yield strength (SMYS) are defined as "major" casing segments.

MFL inspection technology alone does not conclusively identify or quantify the parameters which define a major casing segment. It is therefore the responsibility of the well operator to provide the appropriate casing specifications in advance of the survey for the purpose of pressure-based analysis and reporting.

The high-resolution MFL technology employed for this survey may, under certain conditions, provide data which indicates a casing parameter that differs from the operator's reported values. Such discrepancies, typically in the form of a suspected weight or grade variation, will be brought to the attention of the operator by designating these intervals as "minor" casing segments. A minor segment is therefore identified by the analyst as a subset of the major casing segment reported by the well operator.

If the casing weight or grade of a minor segment can be reliably ascertained by the analyst, it will be noted in the inspection database. However, only the major segment parameters provided and/or approved by the operator will be used for the purpose of pressure-based analysis and reporting. If the well operator subsequently determines to re-specify a minor casing segment for any reason, it then becomes, by definition, a major segment, and the data over this interval must be re-interpreted accordingly.

Major casing segments will be identified and indexed numerically (i.e. 1, 2, 3) by increasing depth, while minor segments will be identified with respect to the major segment in which they occur (i.e. 1.1, 1.2, 2.1).

The major and minor casing segments identified in the course of this survey are summarized in the Casing Segment Report (on the accompanying CD).

### 2.2. External Casings

Any interval of casing positioned coaxially and external to the primary casing undergoing inspection is considered to be an "external casing" for the purpose of this report. External casings do not directly affect the pressure-based analysis in the primary casing, so the presence of one or more external casings has no bearing on the determination of major or minor casing segments, as described above.

External casings can, however, directly affect metal loss feature sizing by altering magnetic interactions within the primary casing. Consequently, all external casing intervals must be identified and compensated for in the course of data analysis.

The start and end positions of all external casings and major/minor casing segments shall be reported as the logging depth whenever these positions can be reliably determined directly from the inspection data. In the absence of sufficient log data, all casing positions will be analyzed and reported according to the casing data provided by the well operator.

The external casings identified during this survey are summarized in the External Casing Report (on the accompanying CD).



### 3. Feature List

Casing "features" are defined as all of the downhole casing components and anomalies identified during the inspection survey.

Features include components related to the physical construction of the well, such as collars, perforations, centralizers, repairs, and downhole hardware. Features also include individual casing anomalies, such as metal loss features, mill-related anomalies, and deformations.

The "Feature List" is simply a comprehensive list of all individual casing features identified during the survey, organized by their position within the well. The position of any feature is always reported as the logging depth to the mid-point, or centerline, of each feature.

The Feature Summary (Table 4, below) lists the casing features identified during the survey, summarized by category.

Table 4: Feature Summary

Occurrences	Description
██████	Casing Joints
██████	Collars
██████	Casing Hardware
██████	Perforated Intervals
██████	Repair Intervals
██████	Metal Loss Features
██████	Mill-Related Anomalies
██████	Deformation Features

The Feature List (on the accompanying CD) contains a complete listing of the features identified during the inspection survey, and serves as the database for all of the individual summaries, reports, and figures contained in this Final Report.

#### 4. Casing Components

The category of "casing components" represents three types of downhole hardware features which contribute to the physical make-up and functionality of the well, and two types of casing anomalies which do not fit within the conventional definition of metal loss features, as described in Section 5.

Casing components associated with downhole hardware include various mechanical features which routinely form part of the well construction, such as collars, centralizers, perforations, mandrels and repairs. The casing joints themselves are analyzed separately, and are therefore not identified as casing "components" for the purpose of this report.

Casing components also include two types of features associated with casing anomalies which fall outside of the conventional metal loss feature definition. These features are mill-related anomalies, which result from the casing manufacturing process, and collar anomalies, which are features associated specifically with the casing collar connections.

The five types of casing components identified by the survey are described and summarized in the sections below.

##### 4.1. Hardware

Casing hardware is determined to mean any physical downhole hardware, other than the casing joints themselves, which comprise the downhole well casing below the log "zero" point, which is typically identified as the top of the master valve or casing flange. Wellhead components above the log zero point are not considered part of the casing or casing components for the purpose of this report.

Casing hardware includes components that serve to connect the casing joints together (e.g., collars), components affixed to the outside of casing (e.g., centralizers, scratchers, clamps), and any class of downhole tools or components which make-up integral to the casing (e.g., mandrels, DV tools, float collars, casing shoes, safety valves, casing packers).

Many casing hardware components represent a significant addition of ferromagnetic material, which adversely affects the tool's magnetic interactions with the casing body. As a result, metal loss anomalies in the casing body which may occur in association with hardware, for example corrosion under a centralizer, are not identified or sized as part of the standard analysis.

The Hardware Summary (Table 5, below) serves to summarize the casing hardware identified during the survey by type.

Table 5: Hardware Summary

Occurrences	Description
1	Collars
1	Centralizers
1	Scratchers
1	Clamps
1	Gas Lift Mandrels
1	DV Tools
1	Girth Welds
1	Casing Shoes
1	Casing Packers
1	Safety Valves
1	Other

The Feature List (on the accompanying CD) contains a comprehensive listing of individual casing hardware components identified during the survey.

#### 4.2. Perforations

Perforations are intervals of the well casing in which perforations, slotted liners or other means of communication with the formation are located. Analysis of the survey data will serve to identify the beginning and end of the perforated intervals, but no attempt is made to ascertain perforation shot type, density, or phasing.

Metal loss anomalies which may occur within the perforated intervals are not identified or sized as part of the standard analysis.

The Perforated Interval Summary (Table 6, below) provides a summary of the perforated intervals identified during the survey.

Table 6: Perforated Interval Summary

Occurrences	Description
1	Perforated Intervals
1	Slotted Liners

The Feature List (on the accompanying CD) contains a comprehensive listing of individual perforated intervals identified during the survey, including their start point, end point, and total length.

#### 4.3. Repair Intervals

Repair intervals are segments of the well that contain existing casing repairs at the time of the survey, such as an internal casing patch, or other form of repair sleeve.

Any metal loss anomalies which may occur within repair intervals are not identified or sized as part of the standard analysis.

The Repair Interval Summary (Table 7, below) provides a summary of the repairs identified during the survey.

Table 7: Repair Interval Summary

Occurrences	Description
██████	Repair Intervals

The Feature List (on the accompanying CD) contains a comprehensive listing of individual existing repair intervals identified during the survey.

#### 4.4. Mill-related Anomalies

Mill-related anomalies are features in the casing body or weld metal resulting from the manufacturing process. Mill-related anomalies may be identified, but not sized, as part of the standard analysis.

Mill-related anomalies are classified in two general categories:

- i. *Manufacturing Anomalies: manufacturing anomalies are features of the manufacturing process which occur in the casing body, such as laminations, inclusions, or scabs.*
- ii. *Seam Weld Anomalies: Seam weld anomalies are features of the manufacturing process which occur in the casing seam weld (if present), such as incomplete fusion or lack of penetration.*

The Mill-related Anomalies Summary (Table 8, below) serves to summarize the mill-related anomalies organized by type.

Table 8: Mill-related Anomalies Summary

Occurrences	Description
██████	Manufacturing Anomalies
██████	Seam Weld Anomalies
██████	Total

The Feature List (on the accompanying CD) contains a comprehensive listing of the mill-related anomalies identified during the survey.

#### 4.5. Collar Anomalies

For the purpose of this report, casing "collars" are defined to include any means of mechanically coupling individual joints of casing together in a well. Collars include conventional casing connection methods utilizing a short external collar, as well as all types of "flush" joint connections, where both the male and female threads are integral to the casing.

Collars are employed to connect two joints of casing together, or to connect one end of a joint of casing to an integral downhole tool, mandrel, or other casing component. Any girth weld occurring below the master valve or casing flange is considered to be a collar, within this report.

The HR Vertilog survey may detect two types of anomalies associated with the collars:

- i. *Collar Anomalies: Metal loss anomalies occurring within the casing body, either under the collar in the case of an external collar, or within the threaded connection interval in the case of a flush joint collar.*
- ii. *Make-up Anomalies: Any MFL collar signature that deviates in one or more material respects (e.g. signature length, amplitude, form) from the typical collar response in the well. For example, a collar signature with an atypically long "gap" between casing ends may indicate cross-threading, insufficient make-up torque, or improper seating, all of which may be a possible sources of collar leaks.*

Collar length is determined according to the length of the MFL signature, which typically exceeds the physical dimensions of the collar connection. Since collars contain threads and other complex metal gain/loss profiles, the capacity of MFL technology to detect and size metal loss features in the casing body may be diminished or eliminated within the collar, depending on the collar type.

Accordingly, collar anomalies may be identified, but are not sized, as part of the standard analysis. If collar anomaly size is provided, the performance specification for anomaly sizing does not apply.

Collar anomalies identified during the survey are included in the Collar Anomaly Summary (Table 9, below), which serves to summarize these features by type.

Table 9: Collar Anomalies Summary

Occurrences	Description
██████	Collar Anomalies
██████	Make-up Anomalies
██████	Total Collars

The Feature List (on the accompanying CD) contains a comprehensive listing of the collar anomalies and make-up anomalies identified during the survey.

## 5. Metal Loss Features

Metal loss features are defined as anomalies in the casing body in which metal has been removed, typically as a result of corrosion or mechanical damage, such as gouging.

Metal loss features detected during the survey are summarized in this report by the following methods:

- i. *Surface location: according to the surface of origin, either internal or external*
- ii. *Depth-based: according to the depth of penetration*
- iii. *Pressure-based: according to the effect on remaining strength of the casing*
- iv. *Feature type: according to a classification based on length, width, and wall thickness*
- v. *Joint summary: according to the most severe features identified per individual casing joint*

### 5.1. Surface Location

The metal loss features detected during the survey are summarized according to their surface location, either internal or external, in the Surface Location Summary (Table 10, below).

Table 10: Surface Location Summary

Occurrences	Description
	Internal Metal Loss Features
	External Metal Loss Features
	Total

The distribution of metal loss features according to their surface location is illustrated in a series of Surface-Based Histograms (Attachment 5.1). Three histograms are presented:

- Surface location: all metal loss features
- Surface location: internal metal loss features
- Surface location: external metal loss features

The vertical axis of each histogram corresponds to the log depth, and the horizontal axis corresponds to the number of occurrences. Each horizontal bar in the histogram represents the total number of occurrences within a 40.00 foot interval of the well.

### 5.2. Depth-Based Analysis

The metal loss features identified during the survey are summarized according to their depth of penetration (DOP) in the Metal Loss Depth-Based Summary (Table 11, below).

The individual metal loss features are summarized in the three columns on the left of the table according to their depth range and surface location. All individual metal loss features identified during the survey are represented in this section of the summary.

In the right hand column of the table, the maximum depth of any metal loss feature within individual joints of casing is summarized. Where more than one metal loss feature is contained in a joint, only the



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feature with the maximum depth of penetration is reported, so that each joint of casing appears in the table only once.

Table 11: Metal Loss Depth-Based Summary

Metal Loss Features			Metal Loss Depth	Number of Joints
Internal	External	Total		
			$0\% \leq d < 20\%$	
			$20\% \leq d < 30\%$	
			$30\% \leq d < 40\%$	
			$40\% \leq d < 50\%$	
			$50\% \leq d < 60\%$	
			$60\% \leq d < 70\%$	
			$70\% \leq d < 80\%$	
			$80\% \leq d$	
			Total	

#### 5.2.1. Maximum Depth

The distribution of metal loss features within the well according to their maximum depth of penetration is illustrated in a series of Maximum Depth Histograms (Attachment 5.2.1). Three histograms are presented:

- Maximum depth: all metal loss features
- Maximum depth: internal metal loss features
- Maximum depth: external metal loss features

The vertical axis of each histogram corresponds to the HR Vertilog Log depth, and the horizontal axis corresponds to the number of occurrences. Each horizontal bar in the histogram represents the total number of occurrences within a 40.00 foot interval of the well.

#### 5.2.2. Depth Range

The distribution of metal loss features within the well according to their depth range is illustrated in a series of Depth Range Histograms (Attachment 5.2.2). Four histograms are presented:

- All metal loss features (all reported depths)
- Metal loss features with  $20\% \leq \text{depth} < 50\%$
- Metal loss features with  $50\% \leq \text{depth} < 80\%$
- Metal loss features with  $\text{depth} \geq 80\%$

The vertical axis of each histogram corresponds to the HR Vertilog Log depth, and the horizontal axis corresponds to the number of occurrences. Each horizontal bar in the histogram represents the total number of occurrences within a 40.00 foot interval of the well.

### 5.2.3. Severity List and Feature Location Sheets

The Depth-Based Severity Report (Attachment 5.2.3) lists the 5 most severe metal loss features detected during the survey, according to their depth of penetration.

In order to help facilitate the location and recovery of these features in the field, the Depth-Based Severity Report includes a Feature Location Sheet for each feature listed.

The Feature Location Sheets includes a description of each feature, and a schematic diagram that indicates a) the feature with respect to casing joint number and depth in the well b) the feature location within the specified casing joint, and c) the joint location with respect to adjacent joints.

### 5.3. Pressure-Based Analysis

Pressure-sentenced ratios are non-dimensional terms which help operators assess the severity of metal loss features detected during the survey.

This report determines the Estimated Repair Factor (ERF) on the basis of operating pressures and metal loss feature assessment methods selected by the operator, and identified in Section 1.2 of this report. The ERF is calculated as follows;

$$ERF = P/P_{safe}$$

Where: P = MAOP, MOP, or other Operator selected pressure value, and

$P_{safe}$  = the safe operating pressure as calculated by the metal loss features assessment method selected by the Operator (e.g. B31G, Modified B31G, Effective Area)

The ERF Summary is presented in Table 12, below.

Table 12: ERF Summary

Occurrences	ERF Values	Number of Joints
██████	Metal loss features with $ERF < 0.6$	██████
██████	Metal loss features with $0.6 \leq ERF < 0.8$	██████
██████	Metal loss features with $0.8 \leq ERF < 0.90$	██████
██████	Metal loss features with $0.9 \leq ERF < 1.0$	██████
██████	Metal loss features with $ERF \geq 1.0$	██████
██████	Total	██████

#### 5.3.1. Pressure-Sentenced Plot

The pressure-sentenced plot graphically displays all metal loss features within each major segment on the basis of feature length (x-axis) and depth (y-axis). The reference line on the



plot corresponds to an ERF equal to 1.0. Metal loss features with a calculated ERF greater than 1.0 plot above the reference line.

This report contains one pressure-sentenced plot for each major pipeline segment defined by the operator. The value for pipeline external diameter,  $D$ , is assumed to be constant throughout each major segment.

Pressure-Sentenced Plots are presented in Attachment 5.3.1.

#### 5.3.2. Pressure-Based Histograms

The distribution of metal loss features within the well, according to their effect on remaining strength, is illustrated in a series of Pressure-Based Histograms (Attachment 5.3.2). Four histograms are presented:

- All metal loss features
- Metal loss features with  $ERF < 0.8$
- Metal loss features with  $0.8 \leq ERF < 1.0$
- Metal loss features with  $ERF \geq 1.0$

The vertical axis of each histogram corresponds to the HR Vertilog log depth, and the horizontal axis corresponds to the number of occurrences. Each horizontal bar in the histogram represents the total number of occurrences within a 40.00 foot interval of the well.

#### 5.3.3. Severity List and Feature Location Sheets

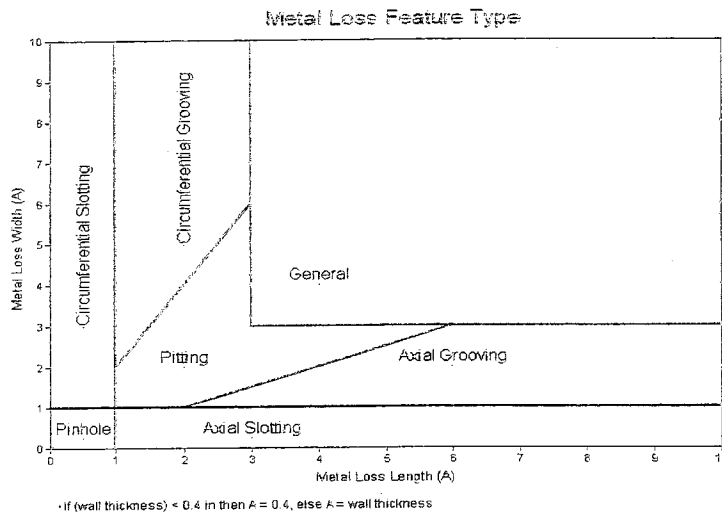
The Pressure-Based Severity Report (Attachment 5.3.3) lists the 5 most severe metal loss features detected during the survey according to their Estimated Repair Factor (ERF).

In order to help facilitate the location and recovery of these features in the field, the Pressure-Based Severity Report includes a Feature Location Sheet for each feature listed.

The Feature Location Sheets includes a description of each feature, and a schematic diagram that indicates: a) the feature with respect to casing joint number and depth in the well; b) the feature location within the specified casing joint, and; c) the joint location with respect to adjacent joints.

#### 5.4. Feature Type

Feature type is a classification system that serves to group metal loss features within one of seven geometric categories. Feature Type classifies features according to their estimated length and width as a function of casing body wall thickness ("t"), as illustrated in the graphic, below.



*Metal Loss Feature Type graphic adapted from the Pipeline Operators Forum (POF)  
Metal Loss Definitions*

The Feature Type Summary (Table 13 below) serves to summarize all metal loss features identified during the survey according to type.

**Table 13: Feature Type Summary**

Feature Type	Occurrences		
	Internal	External	Total
Pinholes			
Pits			
General			
Axial Grooving			
Axial Slotting			
Circumferential Grooving			
Circumferential Slotting			
<b>Total</b>			

The distribution of metal loss by feature type is graphically illustrated in the Feature Type Plot (Attachment 5.4).

## 5.5. Joint Summary

The Joint Summary represents a comprehensive list of the individual joints of casing in the well. By convention, joint numbering starts from the surface, or top logged interval, and increments with increasing well depth.

The Joint Summary uniquely identifies each joint by joint number, start/end depth, length, casing weight and grade. The mid-point, or centerline, of the uphole and downhole collars serves to identify the start and end point of a casing joint.

The Joint Summary additionally describes the condition of each joint in terms of the maximum metal loss feature DOP, and minimum RPR. The individual feature number associated with the maximum DOP and minimum RPR is indicated.

A Joint Classification is assigned to each joint per the well operators' convention based on maximum DOP per joint.

The Joint Classification (Table 14, below) serves to summarize the casing joints by maximum metal loss feature DOP.

Table 14: Joint Classification:

Occurrences	Description
██████	Class 1 (0% - 20%)
██████	Class 2 (20% - 40%)
██████	Class 3 (40% - 60%)
██████	Class 4 (60% - 100%)
██████	Total

The Joint Summary Report (on the accompanying CD) contains a comprehensive listing of the casing joints identified during the survey.

## 6. System Qualification and Quality Control

### 6.1. System Qualification

The HR Vertilog system used to acquire and analyze the magnetic flux leakage casing inspection data and generate this report is a part of Baker Hughes/Baker Atlas Pipe Evaluation Services. Baker Atlas is a recognized industry leader in the field of downhole casing inspection technology, and provides MFL casing inspection services utilizing the Vertilog, Digital Vertilog, MicroVertilog and HR Vertilog series tools on a global basis.

The personnel and equipment used to perform this HR Vertilog inspection survey and analyze the results have been qualified according to the Baker Atlas *HR Vertilog Inspection Systems Qualifications* (SQ 501).

The complete HR Vertilog performance specifications are contained in the *HR Vertilog Performance Specification* (document PS 501).

### 6.2. Best Efforts

All opinions, interpretations, and analysis provided in this report or in connection with this survey are provided to the well operators on a "best efforts" basis. It remains as the sole responsibility of the well operator to use the information contained in this report to draw their own conclusions regarding the condition of the casing, and to undertake appropriate actions to ensure the wells ongoing safety, casing integrity and fitness for purpose.

In the course of analyzing the survey data and producing this report, Baker Atlas Data Analysts have provided the well operator with interpretations based on their experience and judgment, but always within the limits of the inspection technologies employed, and the downhole operating conditions encountered. Since all MFL interpretations and analyses are opinions based on inferences from electrical, magnetic, and other indirect measurements, the accuracy or completeness of any interpretation is not, and can not be, guaranteed.

### 6.3. Analysis Quality Control

The data in this report was processed in accordance with written work instruction *InSight HR Vertilog Analysis* (document WI 501), the purpose of which is to ensure the ongoing consistency, integrity, and quality control over the HR Vertilog analysis process.

### 6.4. Continuous Process Improvement

The InSight™ HR Vertilog analysis software incorporates various technologies to identify and size metal loss features, including a system of supervised learning that relies on known input from large-scale calibration defect sets, magnetic FEA, and recovered casing defects.

Consequently, InSight™ has the capacity to integrate inspection data with recovered metal loss feature dimensions obtained from reliable sources. Such data may include properly identified and procured feature rubbings, dimensioned sketches, scaled photos, laser scans, x-ray, or casing samples.



We invite you to participate in our Continuous Process Improvement program by contacting one of the Baker Atlas representatives listed below. Data from your recovered casing will be used to help expand the understanding of MFL- defect interactions, improve analysis processes, and optimize feature-sizing capabilities.

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## *List of Attachments*

### *Attachment*

1. *Job Information*.....See Report Section 1
2. *Casing Configuration*  
    *Casing Segment Report*  
    *External Casing Report*
3. *Feature List*  
    *Feature List*
4. *Casing Components* .....See Feature List
5. *Metal Loss Features*  
    *Surface-Based Histograms* ..... 5.1  
    *Maximum Depth Histograms* ..... 5.2.1  
    *Depth Range Histograms* ..... 5.2.2  
    *Depth-Based Severity Report* ..... 5.2.3  
    *Pressure-Sentenced Plots* ..... 5.3.1  
    *Pressure-Based Histograms* ..... 5.3.2  
    *Pressure-Based Severity Report* ..... 5.3.3  
    *Feature Type Plot* ..... 5.4  
    *Joint Summary Report* ..... 5.5
6. *Depth Based Report*  
    *Depth Based Report*
7. *Pressure Based Severity Report*  
    *Pressure Based Severity Report*



Casing Segment Report

Inergy Midstream

US Salt

US Salt #58

Identifier	Start Log Position (feet)	Stop Log Position (feet)	Diameter (inches)	Wall Thickness (inches)	Weight (lb/ft)	Type	Grade	SMYS (ksi)	MOP (psi)	Design Factor
1	-3.13	2159.2	9.625	0.352	36	Seamless	API J55	55	1000	1

Inspection Date: 03-24-2011

Report Date: 03-27-2011

External Casings

Inergy Midstream

US Salt

US Salt #58

Start Log Position (feet)	Stop Log Position (feet)	Diameter (inches)	Wall Thickness (inches)	Weight (lb/ft)
-3.13	163.75			

Inspection Date: 03-24-2011  
Report Date: 03-27-2011

Inspection Date: 03-24-2011  
Report Date: 03-27-2011

Attachment 5.1 - Surface Based Histograms



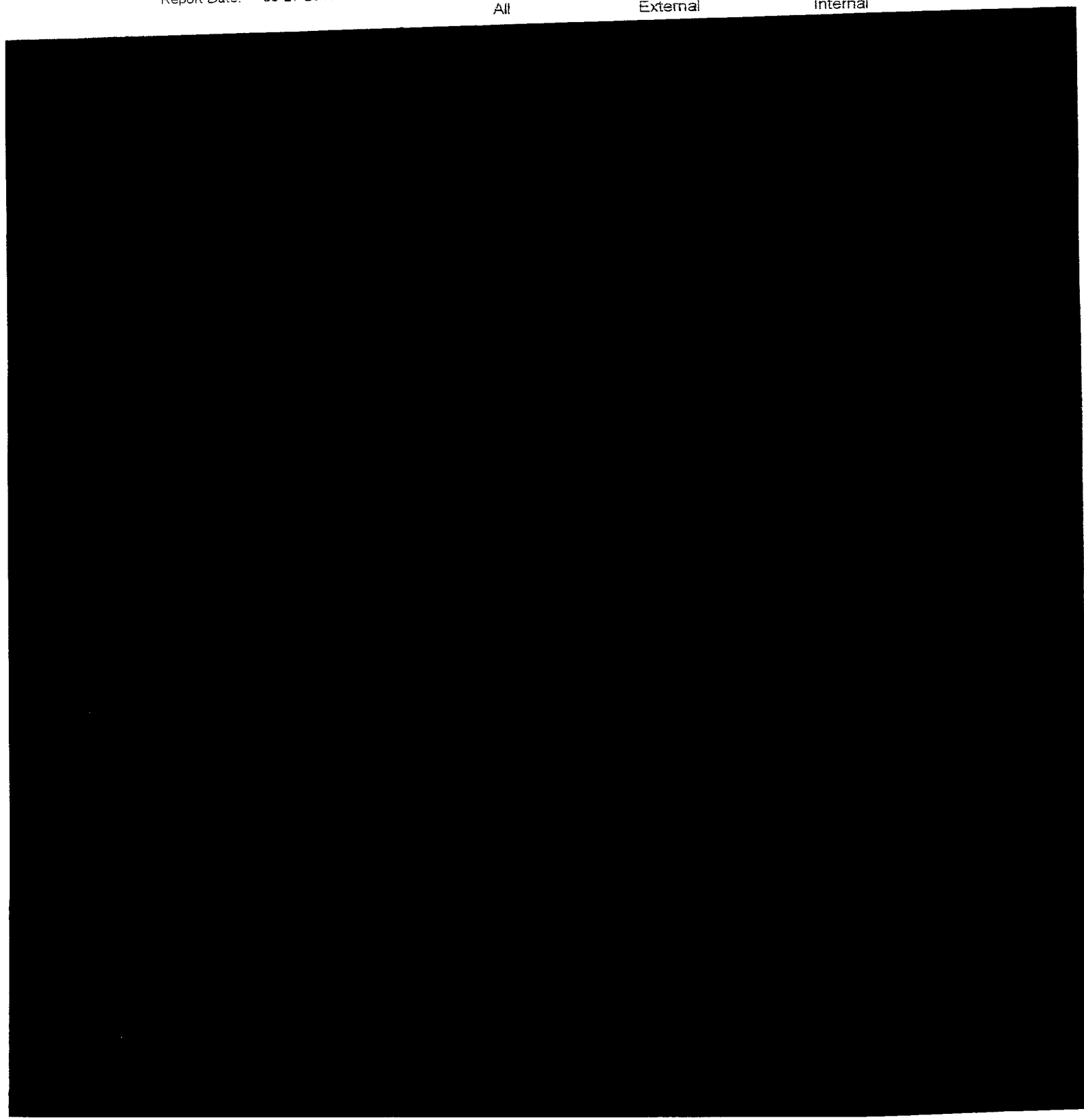
Baker Atlas

Company: Inergy Midstream  
Field: US Salt  
Well: US Salt #58  
Inspection Date: 03-24-2011  
Report Date: 03-27-2011

All

External

Internal



Attachment 5.2.1 - Maximum Depth Histograms

Company: Inergy Midstream

Field: US Salt

Well: US Salt #58

Inspection Date: 03-24-2011

Report Date: 03-27-2011

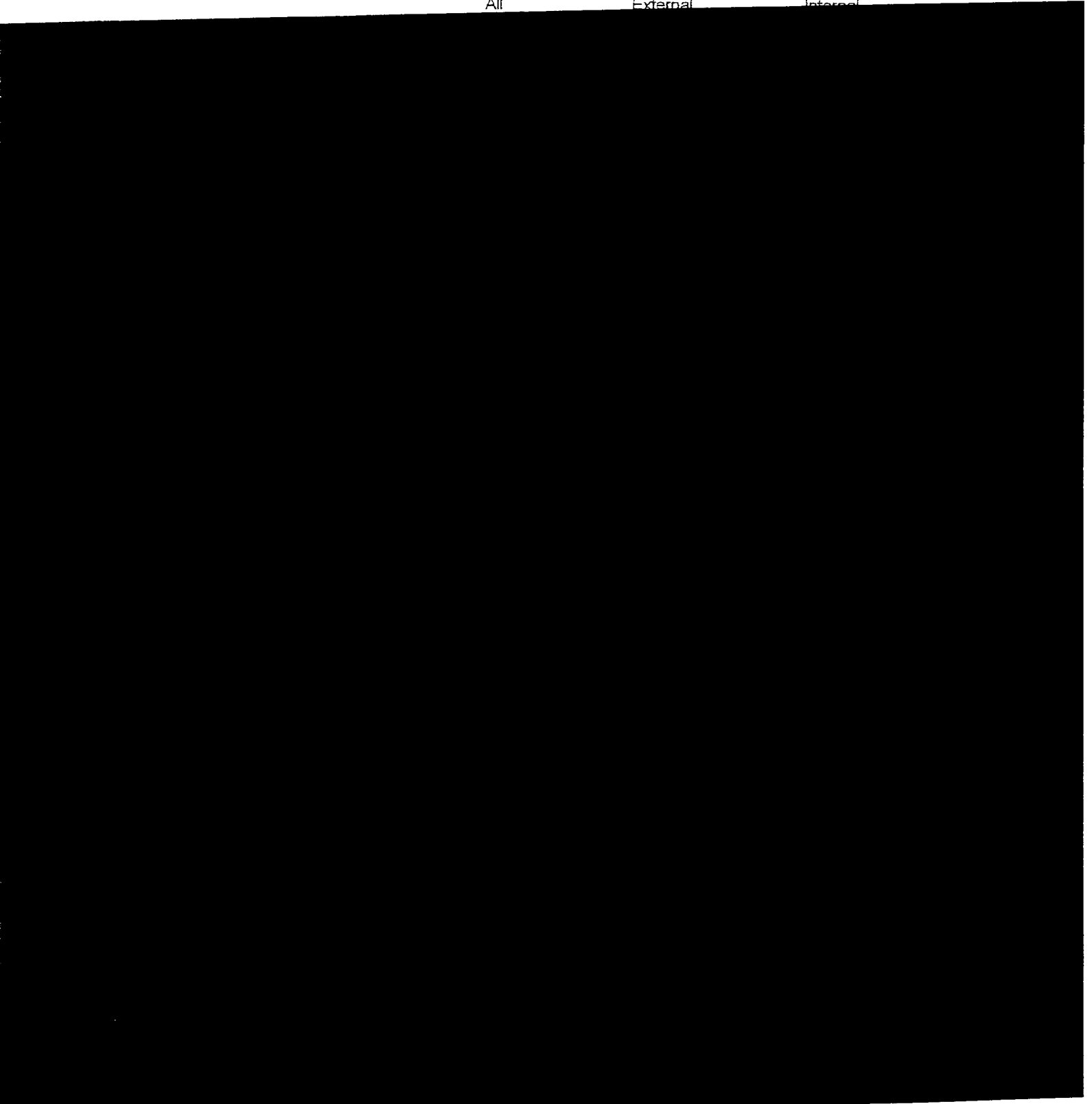


Baker Atlas

All

External

Internal



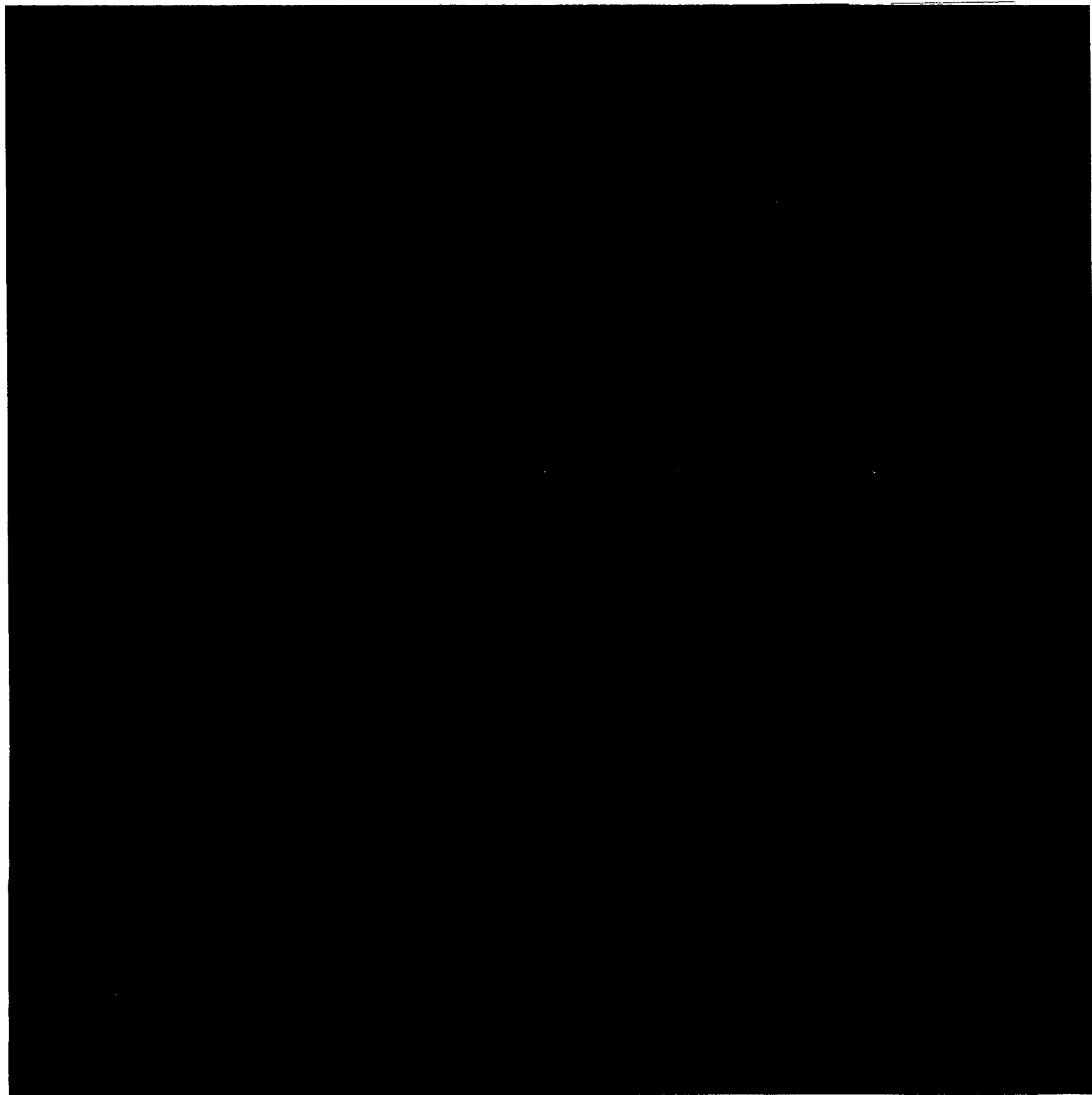
## Attachment 5.2.2 - Depth Range



Company: Inergy Midstream  
Field: US Salt  
Well: US Salt #58  
Inspection Date: 03-24-2011  
Report Date: 03-27-2011

Baker Atlas

(0 < d <= 100%)    (20% <= d < 50%)    (50% <= d < 80%)    (d >= 80%)



# Attachment 5.3.2 - Pressure Based Histograms

Company: Inergy Midstream  
Field: US Salt  
Well: US Salt #58  
Inspection Date: 03-24-2011  
Report Date: 03-27-2011



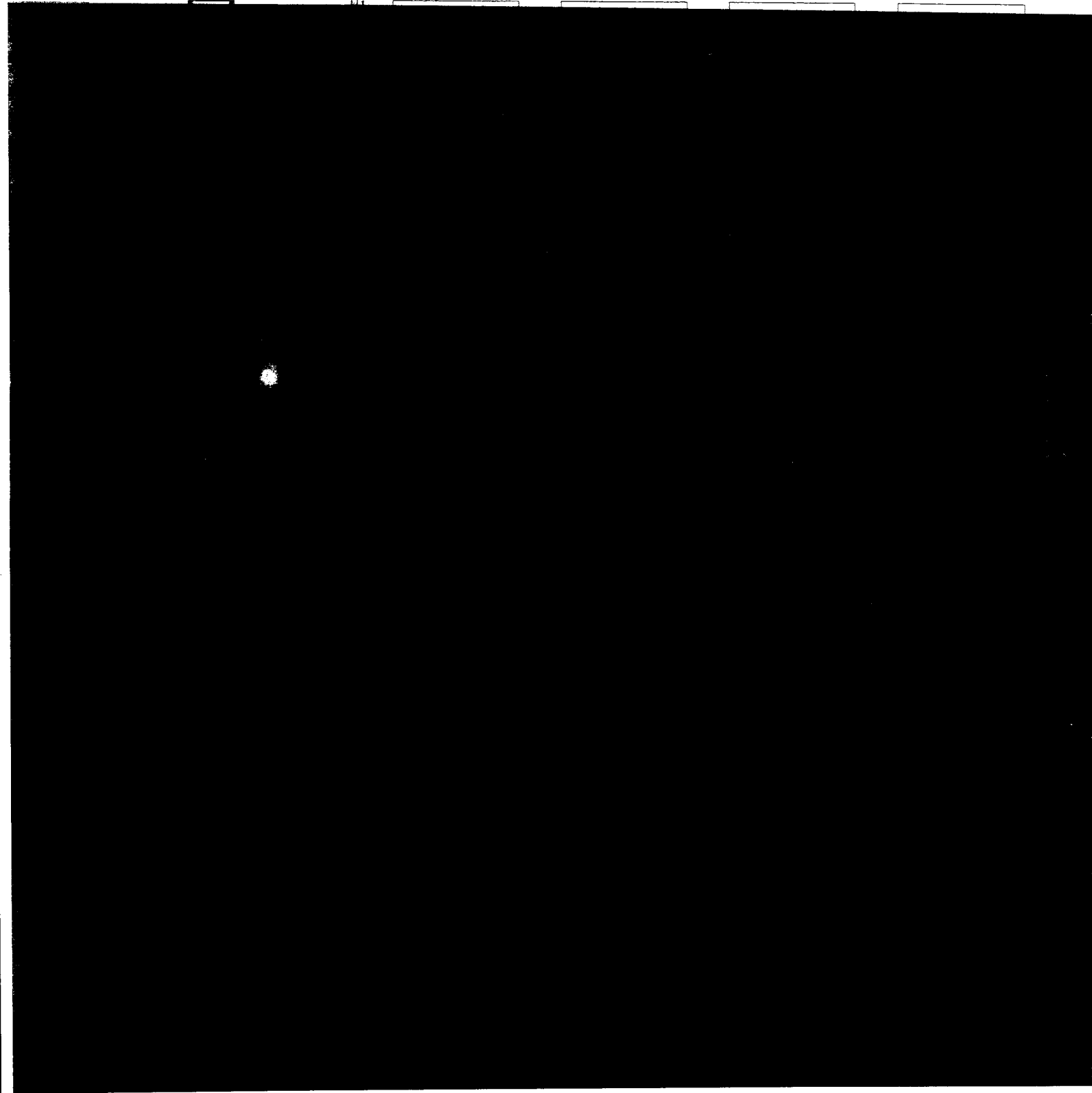
Baker Atlas

All ERF

(ERF < 0.80)

(0.80 <= ERF < 1.00)

(ERF >= 1.00)



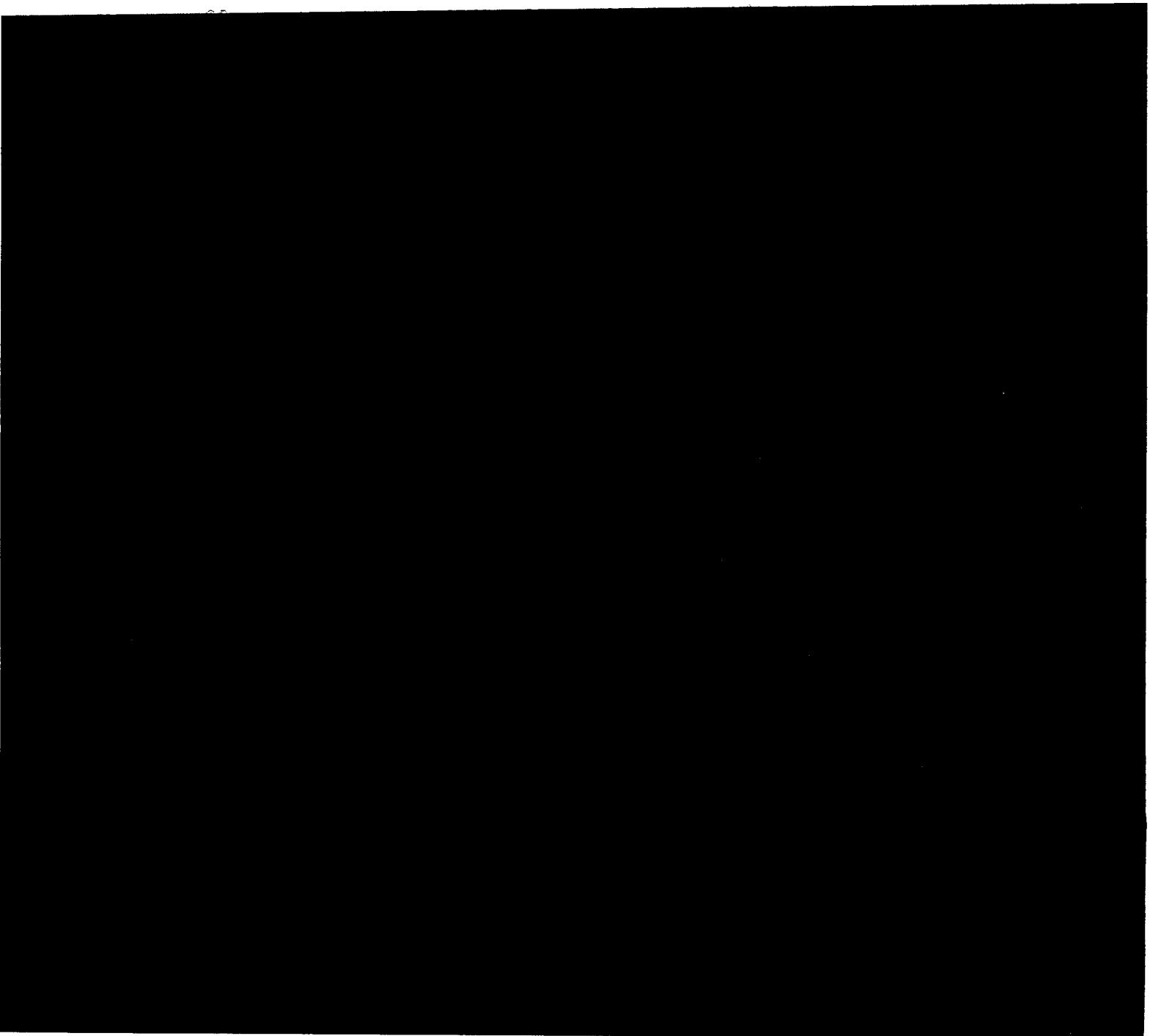
Attachment 5.4 - Feature Type Plot

Company: Inergy Midstream  
Field: US Salt  
Well: US Salt #58  
Inspection Date: 03-24-2011  
Report Date: 03-27-2011



Baker Atlas

All Features





Insight Joint Interpretation Summary

Joint	From	To	Length	Class	Max Depth	Position	Type	ID/OD
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